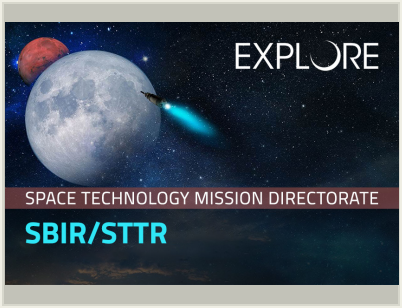
Monolithic Rare Earth Doped PTR Glass Laser, Phase I

Completed Technology Project (2010 - 2010)

Project Introduction

Development of airborne and spaceborne laser systems dictates a number of extremely challenging requirements for such fine optical devices. These requirements include minimizing weight and volume, increasing of power and brightness, high tolerance to mechanical and acoustic vibrations and ionizing radiation. Solid state lasers provide the best parameters which are necessary for free space optical communications, remote sensing, etc. However, all such lasers require fine alignment and, therefore, are very sensitive to vibrations, thermal gradients, etc. The ideal situation would be if all elements of a laser would be incorporated in the volume of a gain medium. We propose a completely new approach to the problem. Researchers at CREOL have demonstrated that it is possible to produce co-doping of a photo-thermo-refractive (PTR) glass with Nd. It was found that absorption and luminescence properties of Nd in PTR glass are the same as for all silicate glasses. It is important that this type of silicate glass can be successfully doped with all rare earth ions, e.g. with Nd, Yb, Er, Tm, etc. At the same time, it was shown that PTR glass keeps it photosensitivity. This means that it is possible to record volume holograms in this material. A combination of good lasing properties and phase photosensitivity enables a new approach to all-solid-state laser. It became possible to record volume Bragg gratings in the volume of laser glass. In this case, all alignment will be done in the process of recording and no misalignment is possible in any conditions of exploitation. Thus, the proposed approach enables creation of a monolithic solid state laser. We expect to study luminescence properties and develop a technology of recording Bragg mirrors in the volume of gain medium and demonstrate diode pumped lasing in Phase I project. In the case of success, we expect to study semiconductor crystals precipitation in PTR glass and demonstrate a monolithic pulsed laser in Phase II project.



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Small Business Innovation Research/Small Business Tech Transfer

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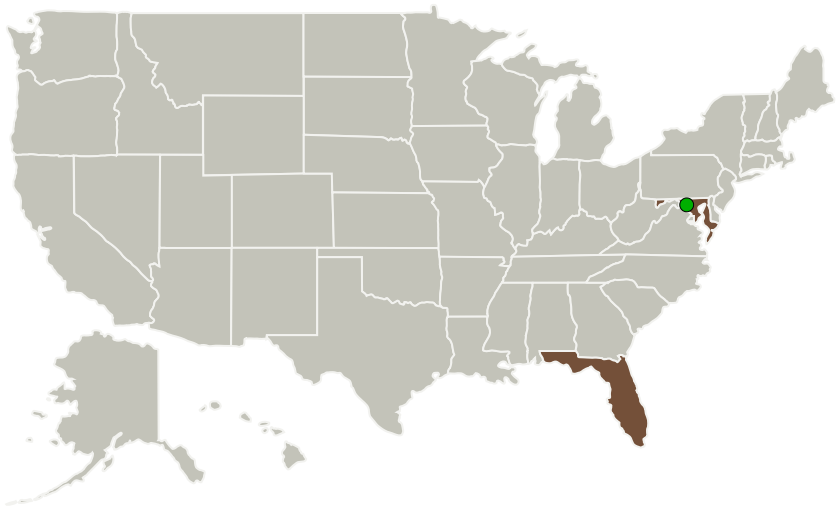
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
OptiGrate Corporation	Lead Organization	Industry	Orlando, Florida
Goddard Space Flight Center(GSFC)	Supporting Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations	
Florida	Maryland

Project Transitions

January 2010: Project Start

July 2010: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/139983)*

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

OptiGrate Corporation

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

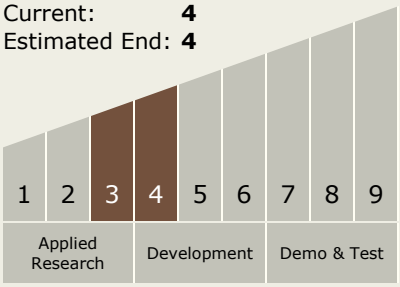
Carlos Torrez

Principal Investigator:

Vadim Smirnov

Technology Maturity (TRL)

Start: **3**
Current: **4**
Estimated End: **4**



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Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.5 Lasers

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System